

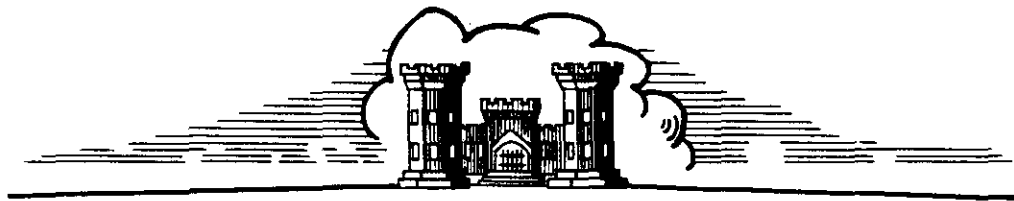
CONNECTICUT RIVER FLOOD CONTROL PROJECT

ENGINEERING DIVISION WORKING
DRAWING

EAST HARTFORD, CONN.
CONNECTICUT RIVER, CONNECTICUT

ANALYSIS OF DESIGN
FOR
CHERRY STREET PUMPING STATION

ITEM E.H.6a - CONTRACT



MARCH, 1941

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE

PROVIDENCE, R.I.

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I. INTRODUCTION

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A. AUTHORIZATION. - The Cherry Street Pumping Station is a part of the local protection works for the town of East Hartford. The East Hartford Dike project is a part of the Connecticut River flood control plan included in the "Report of Survey and Comprehensive Plan for Flood Control in the Connecticut River Valley," March 20, 1937, approved by the Chief of Engineers, November 29, 1937, and published as House Document No. 455, 75th Congress, 2nd session. The project is authorized under the Flood Control Act approved June 28, 1938. Certain modifications in the type of construction and the alignment of the works were recommended by the Chief of Engineers in House Document No. 653, 76th Congress, 3rd session, and authorized in the Act entitled "An Act to provide for the completion of certain local protection works at East Hartford, Connecticut." (Public - No. 859 - 76th Congress - 3rd session), approved October 15, 1940.

B. NECESSITY FOR THE STATION. - To complete the flood protection works for the Town of East Hartford it is necessary to adequately provide for the drainage within the diked area. This requires that gates be provided at the outfalls of the several sewers which flow under the dike. Approximately 35 acres are drained by combined storm water and sanitary sewers with the outfall into the Connecticut River at Cherry Street. To prevent the accumulation of water behind the dike during the periods of high water, the Cherry Street Pumping Station is to be constructed to discharge storm water and sewage into the river. During periods of normal river stage, the effluent and storm runoff will flow to the river by gravity. Pumping will be necessary when the Connecticut

River stage exceeds Elevation 12.3 mean sea level datum.

C. CONSULTATION WITH THE TOWN OF EAST HARTFORD. - Preliminary to and during the actual design of the pumping station, consultations were held with officials representing the Town of East Hartford. These latter include members of the Town Council, the Town Engineer, the head of the Sewer Department, and others. The pumping station design, as finally developed, meets with the approval, in its essentials, of the officials of the Town of East Hartford.

D. SHORT DESCRIPTION OF THE STATION. - The pumping station which will house the pumps and other equipment will consist of a reinforced concrete substructure and a one-story superstructure, of structural steel and brick. Two 16-inch volute pumps will be installed. A reinforced concrete entrance chamber will be provided on the entrance side of the building for racking purposes. The necessary outfall under the dike, and valve chambers have already been built under a former contract (Item FH. 2). A gate is already installed in valve chamber No. 1 which will serve to keep the wet well dry during periods when no pumping is required. The superstructure will have glass block panels to serve as windows. The concrete roof slab will be covered with a cinder concrete fill, pitched to drain, with a built-up type roof composed of four-ply asphalt and gravel. The engine room will contain the gasoline engines and right angle gear units for the two 16-inch pumps. An overhead crane will be installed for handling the equipment. The service gate for back water has already been installed in valve chamber No. 2 at the start of the gravity conduit.

II. SELECTION OF SITE

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The pumping station will be located on Cherry Street as near the landside toe of the dike as is practicable. This location was determined because of the location of the outfall of the drainage system flowing through this site.

III. SOIL INVESTIGATIONS

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Foundation conditions were determined by two 2-1/2" bore holes and one 6" bore hole as located on Plate No. 8, Geologic and Soil Section is shown on Plate No. 9. Numbers in boring logs on this profile are those of the Providence Soil Classification shown graphically on Plate No. 10 and described in Table No. 1.

The station is founded in 6 feet of fill material (classes 4v, 7v and 11-7) containing some cinders. Underlying the fill is 14 feet of class 6-8 silty sand followed by 15 feet of Class 4 medium sand. This medium sand layer is a continuation of the sand stratum in bed of the Connecticut River. Below the sand layer is a bed of soft varved clay 45 feet thick resting on 4 feet of silty sand (class 6-8) and 4 feet of glacial till overlying bed-rock.

Estimated dead load of the station is 0.84 tons per square foot. Excavation release is estimated at 1.11 tons per square foot leaving a net decrease of 0.27 tons per square foot removed from the soil after completed construction. Since the load of station is less than present load on clay, no settlement is expected from station construction.

Settlement from influence of existing dike will be small as consolidation tests show preconsolidation stress was induced into clay by former land surface at about Elevation 36. Existing dike was built during the summer of 1940 and will be consolidated an estimated 50% at time for construction of station in summer of 1941. This is based on observed rate of settlement for this clay. Accordingly settlement of the station caused by dike load will be small. It is estimated in the order of 1/4" to 1/2".

Station grade requires excavation to about Elevation +6.0. Bore hole explorations show water table at this elevation during time of exploration. Subsequent sheet pile installation under dike can be expected to bring the present water table to Elevation 7 or 8 feet due to storage effect of cut-off. During normal stage of river no trouble should be encountered in excavating to Elevation +6. If construction is attempted during high river stage provisions must be made to lower the higher water table.

PROVIDENCE SOIL CLASSIFICATION
U. S. ENGINEER OFFICE
PROVIDENCE, R. I.

TABLE NO. 1

CLASS	DESCRIPTION OF MATERIAL
1	: <u>Graded from Gravel to Coarse Sand.</u> - Contains little medium sand.
2	: <u>Coarse to Medium Sand.</u> - Contains little gravel and fine sand.
3	: <u>Graded from Gravel to Medium Sand.</u> - Contains little fine sand.
4	: <u>Medium to Fine Sand.</u> - Contains little coarse sand and coarse silt.
5	: <u>Graded from Gravel to Fine Sand.</u> - Contains little coarse silt.
6	: <u>Fine Sand to Coarse Silt.</u> - Contains little medium sand and medium silt.
7	: <u>Graded from Gravel to Coarse Silt.</u> - Contains little medium silt.
8	: <u>Coarse to Medium Silt.</u> - Contains little fine sand and fine silt.
9	: <u>Graded from Gravel to Medium Silt.</u> - Contains little fine silt.
10	: <u>Medium to Fine Silt.</u> - Contains little coarse silt and coarse clay. Possesses behavior characteristics of silt.
10 C	: <u>Medium Silt to Coarse Clay.</u> - Contains little coarse silt and medium clay. Possesses behavior characteristics of clay.
11	: <u>Graded from Gravel or Coarse Sand to Fine Silt.</u> - Contains little coarse clay.
12	: <u>Fine Silt to Clay.</u> - Contains little medium silt and fine clay (colloids). Possesses behavior characteristics of silt.
12 C	: <u>Clay.</u> - Contains little silt. Possesses behavior characteristics of clay.
13	: <u>Graded from Coarse Sand to Clay.</u> - Contains little fine clay (colloids). Possesses behavior characteristics of silt.
13 C	: <u>Clay.</u> - Graded from sand to fine clay (colloids). Possesses behavior characteristics of clay.

IV. HYDROLOGY

IV. HYDROLOGY

A. DRAINAGE AREA. - The Cherry Street Station will serve a tributary drainage area of 35 acres. At the present time, approximately 18 acres of this are built-up (commercial and residential development), while the remaining 17 acres are not developed. Located directly on the bank of the Connecticut River, the area has an average ground elevation of from 16 to 22 feet above mean sea level.

1. Present conditions. - Due to frequent flooding in the past, the area has not been highly developed as yet. Some low-cost dwelling represent the extent to which development has progressed. Storm run-off and sanitary sewage are handled by a separate system of drains and sewers. Drains follow the topography of the ground surface with an outfall located on the Connecticut River. A good portion of the drainage is over the ground surface and directly into the river. Reference is made to Plate 11 for limits of the drainage area.

2. Possible future conditions. - Local authorities have been consulted on the possibility of future extension of drainage systems. In their opinion there is no possibility of increasing the drainage area tributary to this pumping station by such drain extension.

B. SEWER FACILITIES. - The Town of East Hartford maintains a separate sewer system in this area.

1. Existing sewers. - Under existing conditions the sewer system is adequate. A storm drain outfall is located at the foot of Cherry Street, while the sanitary sewer discharges into the Connecticut River at the foot of Wilson Street. Except under extreme conditions, the run-off coefficient is very low.

2. Future development. - According to local authorities, the present storm water drains as maintained by the Town of East Hartford will not have to be enlarged to meet future development. Sanitary sewers have ample capacity to serve areas tributary thereto for present and future conditions.

C. SEEPAGE. - The foundation underlying the dike is of varying permeability. The quantity of seepage to be expected through the dike and its foundation at maximum head will be small. Suitable toe drains are constructed to collect all such seepage.

D. STORAGE. - While a certain amount of natural surface storage exists, the topography is such as to allow fairly rapid run-off. In other words, natural storage is not sufficient to produce an appreciable delaying effect. For an area of this size and character it is not feasible to create a basin for storage of peak flows.

V. DETERMINATION OF DISCHARGE CAPACITY

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A. REQUIREMENTS FOR DISCHARGE CAPACITY. - The pumping station will be of sufficient capacity to meet the following requirements;

1. Discharge the storm run-off from the total tributary drainage area. Design criteria are as follows:

a. Run-off caused by a one-half hour storm (time of concentration of this area is approximately 30 minutes) with a probable frequency of occurrence of once in 10 years, occurring in any month, when pumping against a river stage with a probable frequency of occurrence of once in 10 years for that month.

b. Forty percent of the run-off caused by a one-half hour storm with a probable frequency of occurrence of once in 10 years, occurring in any month, when pumping against a river stage with a probable frequency of occurrence of once in 1000 years for that month.

2. Discharge all seepage through the dike and foundation which is brought to the pumping station by the toe drains.

3. Discharge the sanitary sewage from the area.

4. Since no storage pond is provided, the pumps must be capable of discharging the peak inflow as produced by a combination of all the foregoing quantities. Thus the water surface in the suction chamber can be maintained at an elevation which allows the sewers to discharge with free outlets, i.e., without backwater effect.

B. RAINFALL. - The drainage area under consideration has a time of concentration of roughly one-half hour. To get a maximum peak discharge, therefore, a storm of 30-minute duration is used. From previous

studies, monthly rainfall intensity-frequency curves were available for one-hour storms, from 35 years of rainfall records at Hartford, Connecticut. (See Plate No. 4). Similar records for 30-minute storms were not available. Therefore, a comparison of rainfall for 30-minute and one-hour storms was made from data presented in Misc. Pub. #204 U.S.D.A., "Rainfall Intensity-Frequency Data", by D. L. Yarnell. It was found that, for all practical purposes, the ratio of rainfall of a one-hour storm to a 30-minute storm is 1.25. This gave a means of transposing the one-hour storm to a 30-minute storm. The following table indicates the computation:

<u>Month</u>	<u>1-hour storm 10-year frequency (from Hartford records) inches</u>	<u>30-minute storm 10-year frequency (1-hr. values/1.25) inches</u>
January	0.55*	0.44
February	0.44*	0.35
March	0.47	0.38
April	0.54	0.43
May	0.65	0.52
June	1.16	0.93
July	1.44	1.15
Aug.	1.41	1.13
Sept.	1.09	0.87
Oct.	0.73	0.58
Nov.	0.53	0.42
Dec.	0.50*	0.40

* Rainfall intensity from Providence, R. I. records.

C. RUN-OFF COEFFICIENTS. - From a study of the average monthly run-off for nearby watersheds, it was found that the run-off coefficients for the months of November, December, January, February, March, and April were high, and were therefore grouped together. The run-off coefficients for the months of May, June, July, August, September, and October were found to be relatively low, and were grouped together. The following table shows the run-off coefficients which were selected for the various types of area. These coefficients were weighted according to the amount of each type of development, to obtain weighted run-off coefficients for the entire area for the winter and summer months.

RUN-OFF COEFFICIENTS

Season	Run-off coefficient		Weighted run-off coefficient
	Commercial and residential 18 acres	Undeveloped 17 acres	
November through April	0.60	0.30	0.45
May through October	0.40	0.20	0.30

D. FREQUENCY OF RIVER STAGES. - The monthly stage-frequency curves of the Connecticut River at East Hartford, Conn., shown on Plate No. 5, supply the 10-year and 1000-year frequency stages for each month. Plate No. 6 shows the stage-duration curve for the Connecticut River at East Hartford.

E. REQUIRED DISCHARGE CAPACITY FOR SURFACE RUN-OFF. - The run-off from the area was determined by use of the formula:

$$Q = C I A$$

in which

Q = discharge from the total drainage area in c.f.s.;

C = the weighted run-off coefficient;

I = intensity in inches per hour for the 30-minute storm;

A = total drainage area tributary to the pumping station,
in acres.

The following table shows the relationship between the rate of run-off and the corresponding river stage.

Month	30 min. 10-yr. intensity, in inches per hour	Weighted run-off coeff.	Run-off c. f. s.	Connecticut River stage (m. s. l.)		40% of 10-yr. run-off c. f. s.
				10-year	1000-year	
Jan.	0.88	0.45	13.9	13.9	23.3	5.6
Feb.	0.70	0.45	11.0	15.7	27.8	4.4
Mar.	0.76	0.45	12.0	23.2	40.2	4.8
Apr.	0.86	0.45	13.5	23.5	28.9	5.4
May	1.04	0.30	10.9	18.6	22.2	4.4
June	1.86	0.30	19.5	14.1	21.5	7.8
July	2.30	0.30	24.2	9.9	21.3	9.7
Aug.	2.26	0.30	23.7	8.5	20.3	9.5
Sept.	1.74	0.30	18.3	10.2	34.9	7.3
Oct.	1.16	0.30	12.2	12.4	33.3	4.9
Nov.	0.84	0.45	13.2	14.1	30.8	5.3
Dec.	0.80	0.45	12.6	16.2	25.4	5.0

The variation in storm run-off with river stage is illustrated graphically on Plate No. 7.

F. REQUIRED DISCHARGE CAPACITY FOR SEWAGE. - The amount of sanitary sewage to be pumped is, for all practical purposes, a negligible quantity. Assuming the area to be populated to the extent of 25 persons per acre (actual population at the present time is much less), and an estimated flow of 200 gallons per capita per day, a figure of 0.27 c.f.s. is computed. An allowance of 0.5 c.f.s. is made in the final combination of quantities. At the present time sewage is discharged into the Connecticut River without treatment of any kind, although sewage treatment will probably be undertaken in the not distant future.

G. REQUIRED DISCHARGE CAPACITY FOR SEEPAGE FLOW. - Seepage flow through the dike and its foundation is treated under another section of this design analysis. Construction features are such as to hold probable seepage to a low value, thus reducing the item to one of secondary importance. It is estimated that the 3100 feet of dike tributary to Cherry Street Station will contribute about 2 c.f.s. as seepage flow when the Connecticut River is at high flood stages.

H. REQUIRED PUMP CAPACITY. - No capacity for storing inflow is available, therefore the pumps will be required to handle the total combined inflow as covered under foregoing paragraphs E, F and G. Plate No. 7 gives the combined inflow over the entire range of river stage. The pumps must be capable of expelling the combined inflow shown by this curve (Plate No. 7) against its corresponding head.

VI. MECHANICAL DESIGN

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A. PUMP DRIVE. - The Cherry Street Pumping Station is one of three flood control pumping stations to be constructed in East Hartford, Connecticut. Prior to the design of any of the stations, an investigation was made of reliability and cost of electric power and after conference with the town officials, it was decided that gasoline engines should be used for driving the pumps.

The gasoline engines for the Cherry Street Pumping Station will be of the heavy duty industrial type capable of continuously driving the pumps at their rated speed under any head condition developed. The engines will develop about 80 H.P. and will ordinarily not be required to deliver over 80 percent of this power. They will be mounted on concrete bases and directly connected through flexible couplings to the right angle gear units.

B. PUMPS. - From the ultimate required pumping capacity of 22.0 c.f.s., as determined in Section V, it was determined that provisions should be made to install two pumps. To install more than two pumps would materially increase the cost of the station without resulting in any great advantage and to provide but one pump would seriously limit the reliability of the station and its operating flexibility.

No provisions were made in the capacity determined in Section V for possible mechanical failure of equipment. To provide for this contingency, it is considered necessary that either pump should be capable of delivering about 85 percent of the 22.0 c.f.s., or 19.0 c.f.s. This factor results in a total station capacity of 38.0 c.f.s. A study of pumping equipment indicated that two 16-inch volute pumps would be re-

quired; each pump to have a capacity of 8,500 G.P.M., or 19.0 c.f.s. against a static head of 0 feet and 4,500 G.P.M., or 10.0 c.f.s. against a static head of 24 feet.

C. RIGHT ANGLE GEAR UNITS. - The gear units will be of the self-contained type designed for transmitting the power from the horizontal engine shaft through a gear train to the vertical pump shaft. The units will be enclosed in a cast iron and structural steel housing and will have a service factor of not less than 1.25 at the maximum power required to drive the pumps under any condition of head.

D. CRANE. - A four-ton overhead crane will be installed in the engine room to facilitate the repairing of any items of equipment. The crane will be of standard construction and hand operated throughout.

E. SUMP PUMP. - A sump pump will be provided in the pump room to take care of a 4-inch drain from a valve chamber in the gravity flow pipe line adjacent to the pumping station and any leakage in the station itself.

F. GASOLINE SYSTEM. - Gasoline will be stored in a 500 gallon tank buried in the ground adjacent to the pumping station. Each engine will be supplied through an individual line running directly to the tank. Drip pans will be provided on the engines and connected to a common header running back to the tank. All gasoline piping will be 3/4" I.D. copper tubing with flared joint connections. At such points where the gasoline lines are imbedded in concrete or pass through beams, they will be protected by wrought iron pipe sleeves.

G. HEATING SYSTEM. - The heating system will consist of an oil-burning heating stove of the cabinet type with built-in-electrically-driven blower which will provide heat circulation throughout the engine room.

H. ELECTRIC LIGHT AND POWER SYSTEM. - The electric energy for light and power in the pumping station will be supplied at 115 and 230 volts, single phase, 3 wire grounded neutral, 60 cycles, A. C. from the Hartford Electric Light Company's power system. Metering of power will be done in the pumping station. In case of an interruption of power from this source, provisions have been made so that emergency lights in the station can be supplied from the 12-volt engine batteries. The A. C. electric system will provide for entrance lights, engine room and pump room lights, convenience outlets, sump pump power and a battery charger for the engine batteries. All circuits will be controlled from a six-circuit panelboard having an automatic air circuit breaker in each branch circuit. The D. C. emergency lighting system will consist of two lights, one in the engine room, and one in the pump room.

VII. STRUCTURAL DESIGN

VII. STRUCTURAL DESIGN

A. SPECIFICATIONS FOR STRUCTURAL DESIGN.

1. General. - The structural design of the Cherry Street Pumping Station has been executed in general in accordance with standard practice. The specifications which follow cover the conditions affecting the design of the reinforced concrete and structural steel.

2. Unit weights. - The following unit weights for material were assumed in the design of the structure:

Water	-	62.5 pounds per cubic foot
Dry earth	-	100 pounds per cubic foot
Saturated earth	-	125 pounds per cubic foot
Concrete	-	150 pounds per cubic foot

3. Earth pressures. - For computing earth pressure caused by dry earth, Rankine's formula was used. For saturated soils an equivalent liquid pressure of 80 pounds per square foot per foot of depth was assumed.

4. Structural steel. - The design of structural steel was carried out in accordance with the Standard Specifications for Steel Construction for Buildings of the American Institute of Steel Construction.

5. Reinforced concrete. - In general all reinforced concrete was designed in accordance with the "Joint Committee on Standard Specifications for Concrete and Reinforced Concrete" issued in January 1937.

a. Allowable working stress. - The allowable working stress in concrete used in the design of the pump house structure and conduits are based on a compressive strength of 3,000 pounds per square inch in 28 days.

<u>b.</u>	<u>Flexure (f_c).</u>	<u>Lbs. per sq. in.</u>
	Extreme fibre stress in compression	800
	Extreme fibre stress in compression adjacent to supports of continuous or fixed beams or rigid frames	900
<u>c.</u>	<u>Shear (v).</u>	
	Beams with no web reinforcement and without special anchorage	60
	Beams with no web reinforcement but with special anchorage of longitudinal steel	90
	Beams with properly designed web reinforcement but without special anchorage of longitudinal steel	180
	Beams with properly designed web reinforcement and with special anchorage of longitudinal steel .	270
	Footings where longitudinal bars have no special anchorage	60
	Footings where longitudinal bars have special anchorage	90
<u>d.</u>	<u>Bond (u).</u>	
	In beams, slabs, and one way footings ..	100
	Where special anchorage is provided	200
	The above stresses are for deformed bars.	
<u>e.</u>	<u>Bearings (f_c).</u>	
	Where a concrete member has an area at least twice the area in bearing	500

f.	<u>Axial compression (f_y).</u>	<u>Lbs. per sq. in.</u>
	Columns with lateral ties	450
g.	<u>Steel stresses.</u>	
	Tension	18000
	Web reinforcement	16000
h.	<u>Protective concrete covering.</u>	

<u>Type of members</u>	<u>Minimum cover in inches</u>
Interior slabs	1-1/2
Interior beams	2
Members poured directly against the ground	4
Members exposed to earth or water but poured against forms ..	3

For secondary steel, such as temperature and spacer steel, the above minimum cover may be decreased by the diameter of the temperature or spacer steel rods.

B. BASIC ASSUMPTIONS FOR DESIGN.

1. Roof slab. - The roof slab is of reinforced concrete. It is designed to carry the full dead load plus a live load of 40 pounds per square foot of roof surface.

2. Roof beams. - The roof beams are of structural steel encased in concrete fireproofing. They are designed to carry the full dead load, plus the full live load of 40 pounds per square foot of roof surface. The middle beam, together with the columns to which it is connected, form a portal frame which takes up wind load and crane thrusts on the building. The end connections are designed to take up all such horizontal loads.

3. Columns. - Structural steel columns in the walls of the superstructure take up the direct roof loads as well as all wind loads on the sides of the superstructure. In addition, the columns carry crane brackets which support the crane runway. They are designed to carry full live and dead load from the roof; dead load, live load, and impact effect from the traveling crane; bending due to eccentrically applied loads, and bending due to wind load on the building. No point of inflection was considered in the column design, a pin-ended condition being assumed.

4. Engine room floor. - The engine room floor is designed to carry all engines, motors, etc., actually to be placed on that floor, as well as a uniform load.

The following assumptions were made for design purposes:

a. For the floor slab, the design loads are the estimated dead loads plus a uniform live load of 250 pounds per square foot.

b. For the removable steel floor plates, the design loads are the estimated dead load plus a uniform load of 250 pounds per square foot.

c. For the floor beams, the design loads are the estimated dead loads, the actual machinery loads, and a uniform load of 200 pounds per square foot on the unoccupied portion of the floor slabs which contribute loads to the beams under consideration. For the machinery loads an impact factor of 100 percent has been added.

5. Pump room walls and floor slab.

a. In designing the pump room walls and floor slab, the assumption was made that the walls are simply supported at the top

edges and continuous with the floor slab at the bottom. This assumption seems reasonable in view of the fact that the engine room floor slab is only 7-1/2 inches thick and the engine room floor beams do not provide continuous wall support. The floor beams do, however, serve as stiffeners for the slab and help the latter to take up the thrust from the walls. Actually, the floor beams will take up a part of the wall thrusts and will thereby provide an added factor of safety.

b. The loading on the frame formed by the pump room walls and floor slab consists of the vertical load from the superstructure, the vertical loads from the engine room floor; the vertical loads on the floor slab from the pumps and that brought down by the walls; and the thrusts against the walls, made up of direct earth pressure plus horizontal reactions and moments brought against the walls by the suction chamber roof slab.

From the loadings noted, bending moments were computed in the pump room walls and floor slab, as well as in the suction chamber slabs and wall.

VIII. CONSTRUCTION PROCEDURE

VIII. CONSTRUCTION PROCEDURE

A. SEQUENCE OF OPERATIONS. - The schedule of work will require the contractor to complete all work within 250 calendar days. The feeder sewers, valve chambers, and outfall conduits under the dike are complete, having been constructed under a previous contract. The construction work under this contract will follow the logical order of construction procedure and connections will be made to the existing sewer and outfall. The area will be subject to flooding throughout most of the construction period when the stage in the river exceeds elevation 18 approximately.

B. CONCRETE CONSTRUCTION. - The composition of concrete and methods of control of aggregates are covered in the specifications.

C. STRUCTURAL STEEL CONSTRUCTION. - Structural steel construction consists of the frame work for the superstructure; the stairway in the pump room; the trash rack, and the miscellaneous frames, angles, cheekered plates, crane rails, railings, and ladders.

IX. SUMMARY OF COST

IX. SUMMARY OF COST

The total construction cost of the Cherry Street Pumping Station, including the mechanical equipment, has been estimated to be \$44,500, including 10 percent for contingencies and 15 percent for engineering and overhead.

This amount has been distributed as follows:

(1) Pumping station

<u>a.</u>	Concrete features	\$ 7,100
<u>b.</u>	Superstructure	9,400
<u>c.</u>	Miscellaneous	<u>4,400</u>
		20,900

(2) Mechanical equipment 23,600

Total 44,500

(1) a. The concrete features included under the pumping station item (1) a consist of the entrance chamber and building foundation to and including the operating floor slab.

(1) b. The superstructure consists of the complete building above the operating floor.

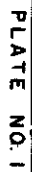
(1) c. Miscellaneous items are common excavation and backfill for the building, miscellaneous iron and steel, trash rack, and all other items not included in (1) a and (1) b.

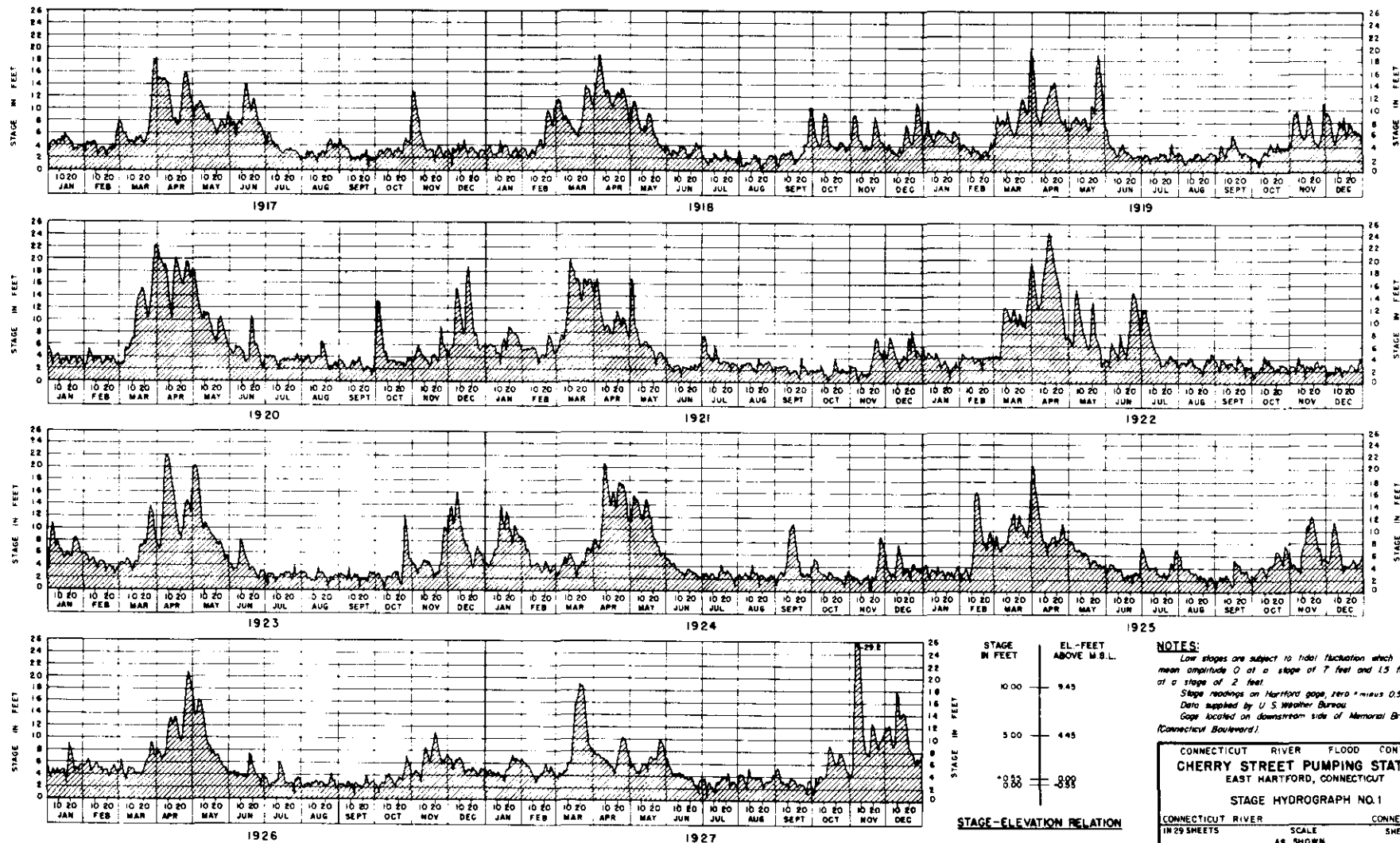
(2) The mechanical equipment consists of the pumps, gas engines, electric motors, gear units, crane, generating units, valves and piping, sluice gates, and miscellaneous items.

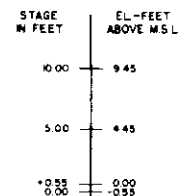
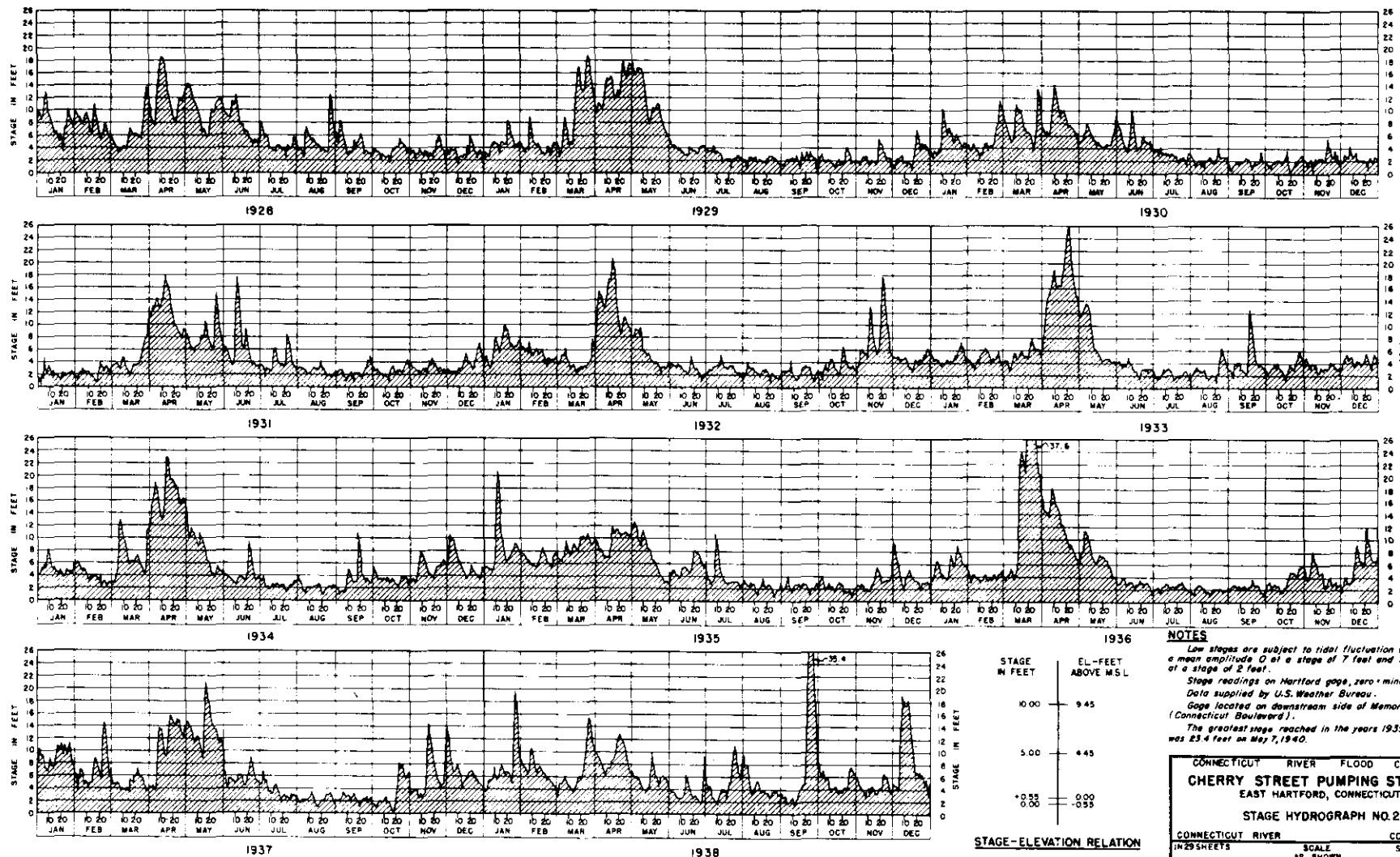
PLATES

INDEX OF PLATES

Plate No. 1	Project Location and Index
Plate No. 2	Hydrograph No. 1
Plate No. 3	Hydrograph No. 2
Plate No. 4	Rainfall Intensity Frequency Curve
Plate No. 5	Stage Frequency Curves
Plate No. 6	Stage Duration Curve
Plate No. 7	Required Pump Capacity Curve
Plate No. 8	Subsurface Exploration
Plate No. 9	Geologic and Soil Section
Plate No. 10	Providence District Soil Classification
Plate No. 11	General Plan
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Plate No. 17	Pumping Capacity
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NOTES

Low stages are subject to tidal fluctuation which has a mean amplitude of a stage of 7 feet and 1.5 feet at a stage of 2 feet.

Stage readings on Hartford gage, zero minus 0.55 M.S.L.

Data supplied by U.S. Weather Bureau.

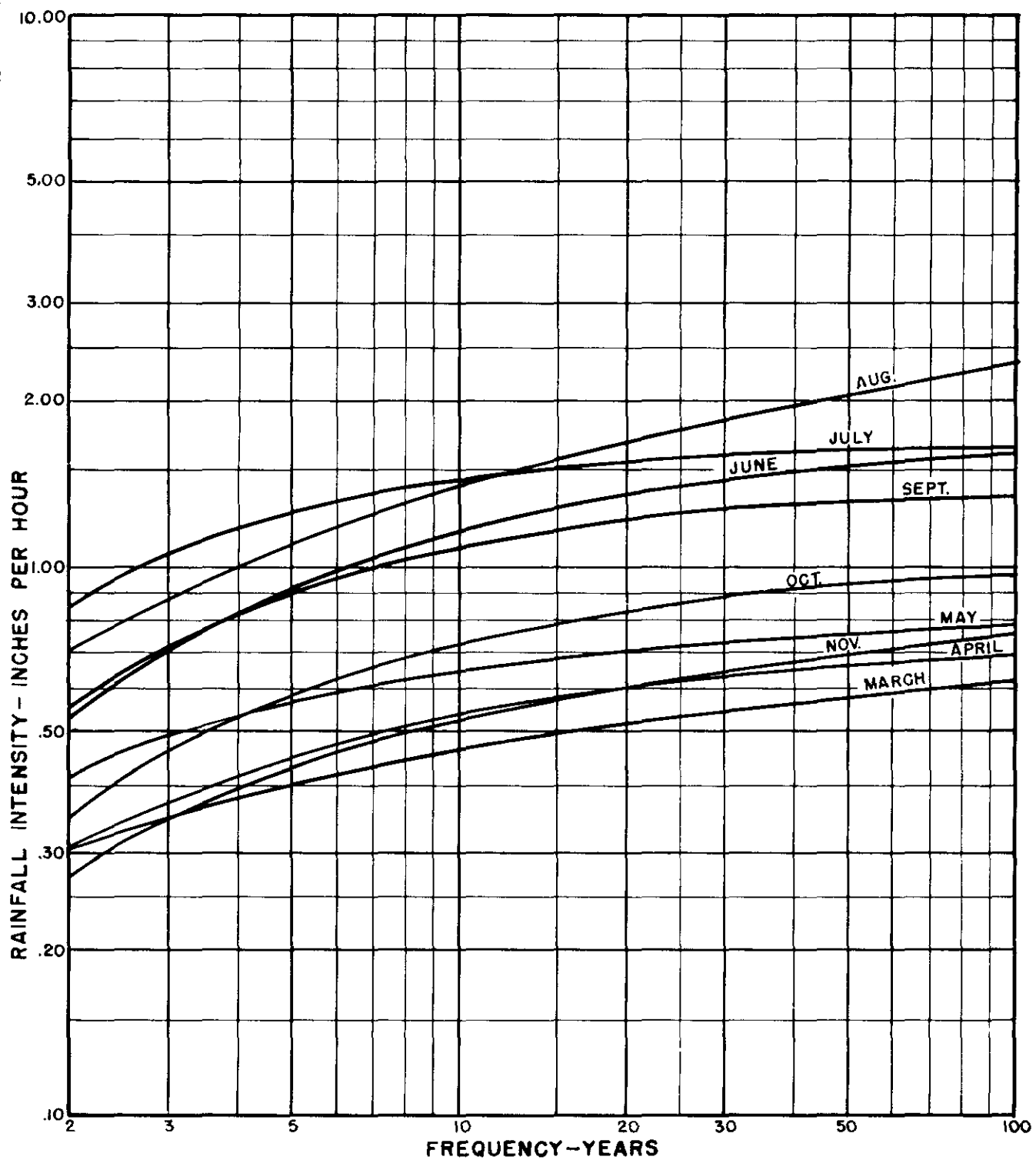
Gage located on downstream side of Memorial Bridge (Connecticut Boulevard).

The greatest stage reached in the years 1939 and 1940 was 23.4 feet on May 7, 1940.

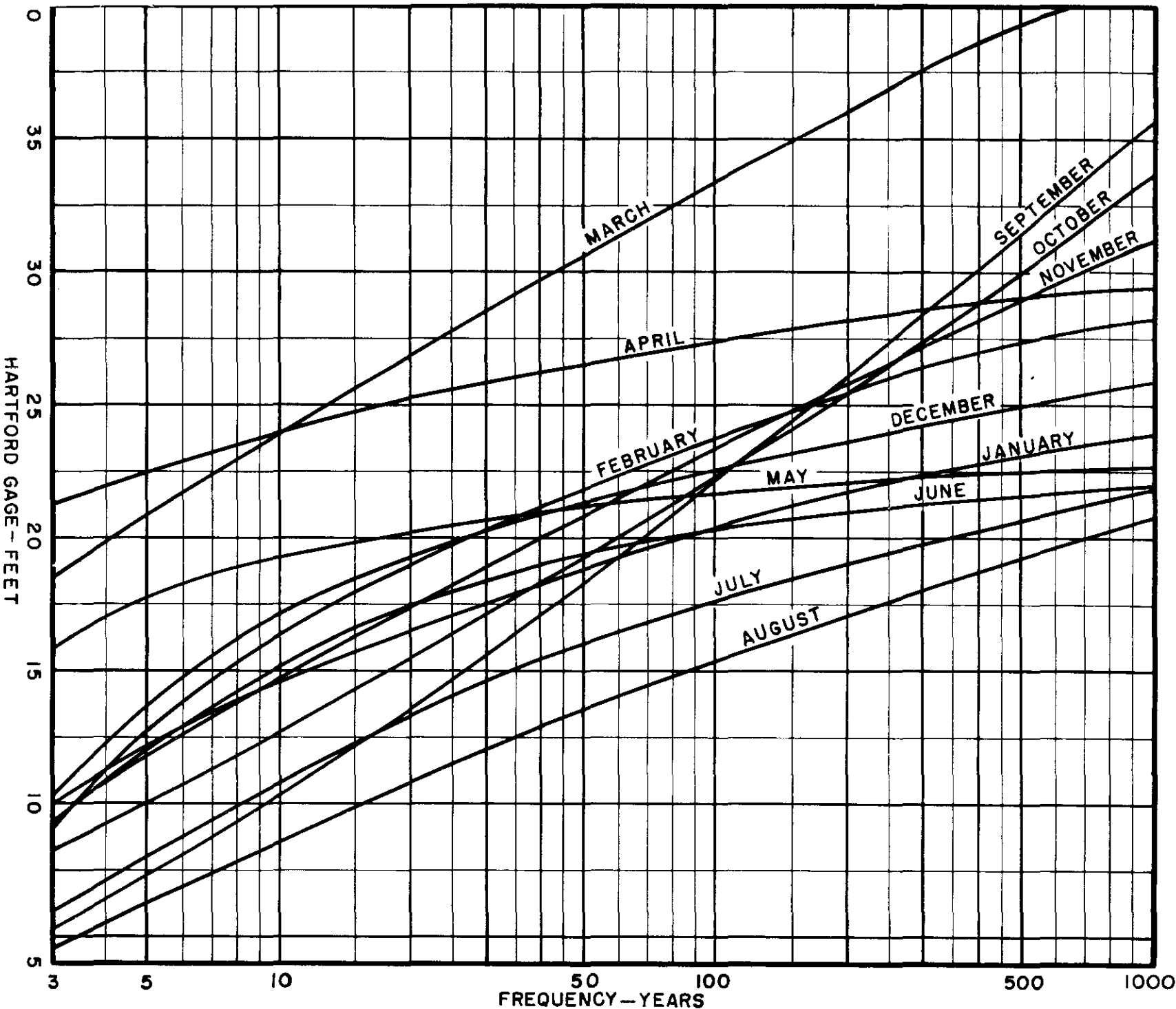
CONNECTICUT RIVER FLOOD CONTROL
CHERRY STREET PUMPING STATION
EAST HARTFORD, CONNECTICUT
STAGE HYDROGRAPH NO. 2

CONNECTICUT RIVER CONNECTICUT
IN 29 SHEETS AS SHOWN SHEET NO. 4
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1941
DESIGNED BY: [Signature] CHECKED BY: [Signature]
DRAWN BY: [Signature] PLOTTED BY: [Signature]
FISCAL YEAR 1941
FILE NO. CT-3-1200

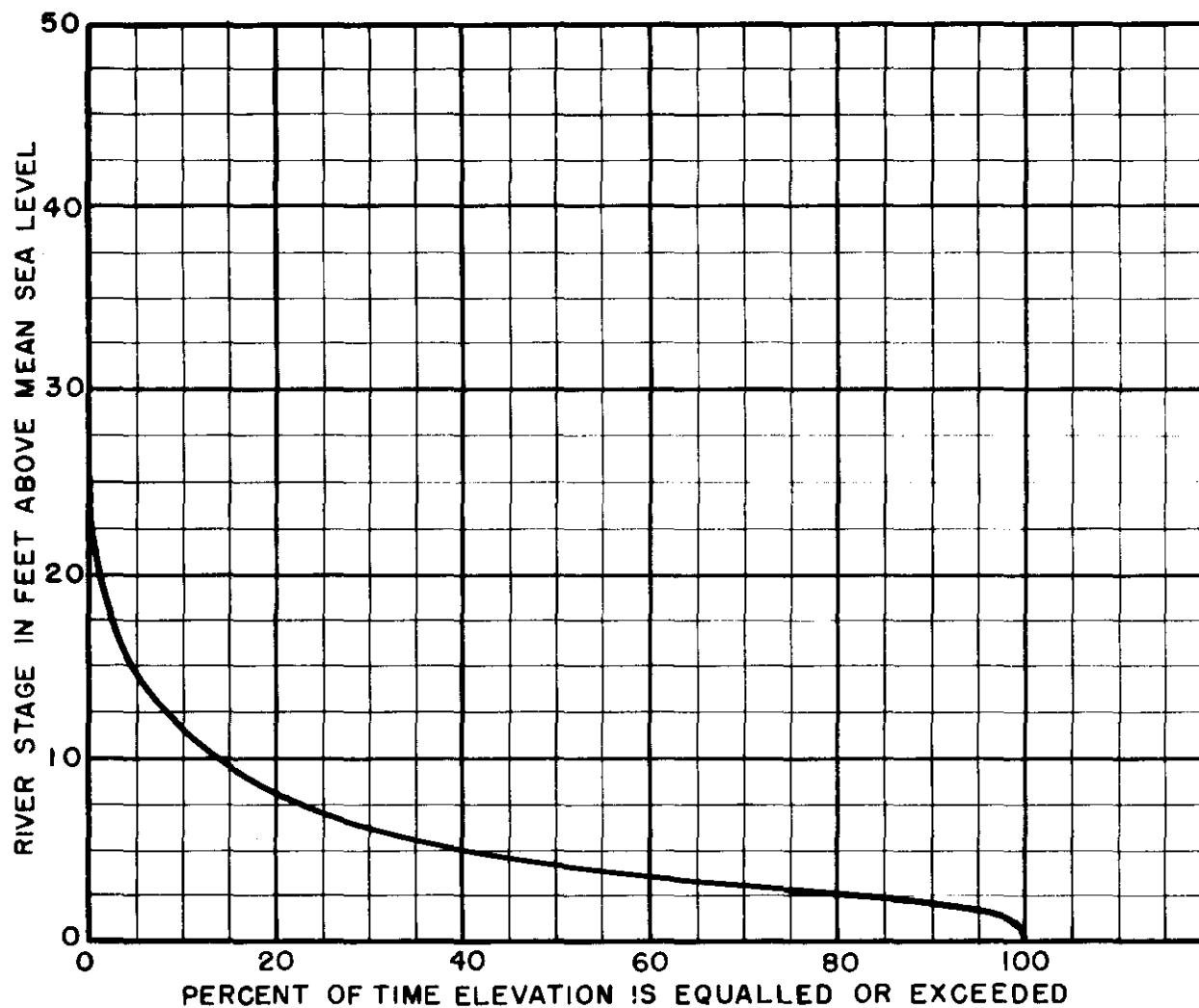
KEY	DATE	REVISION (Indicated by Δ)	REVIEWED BY	APPROVED BY



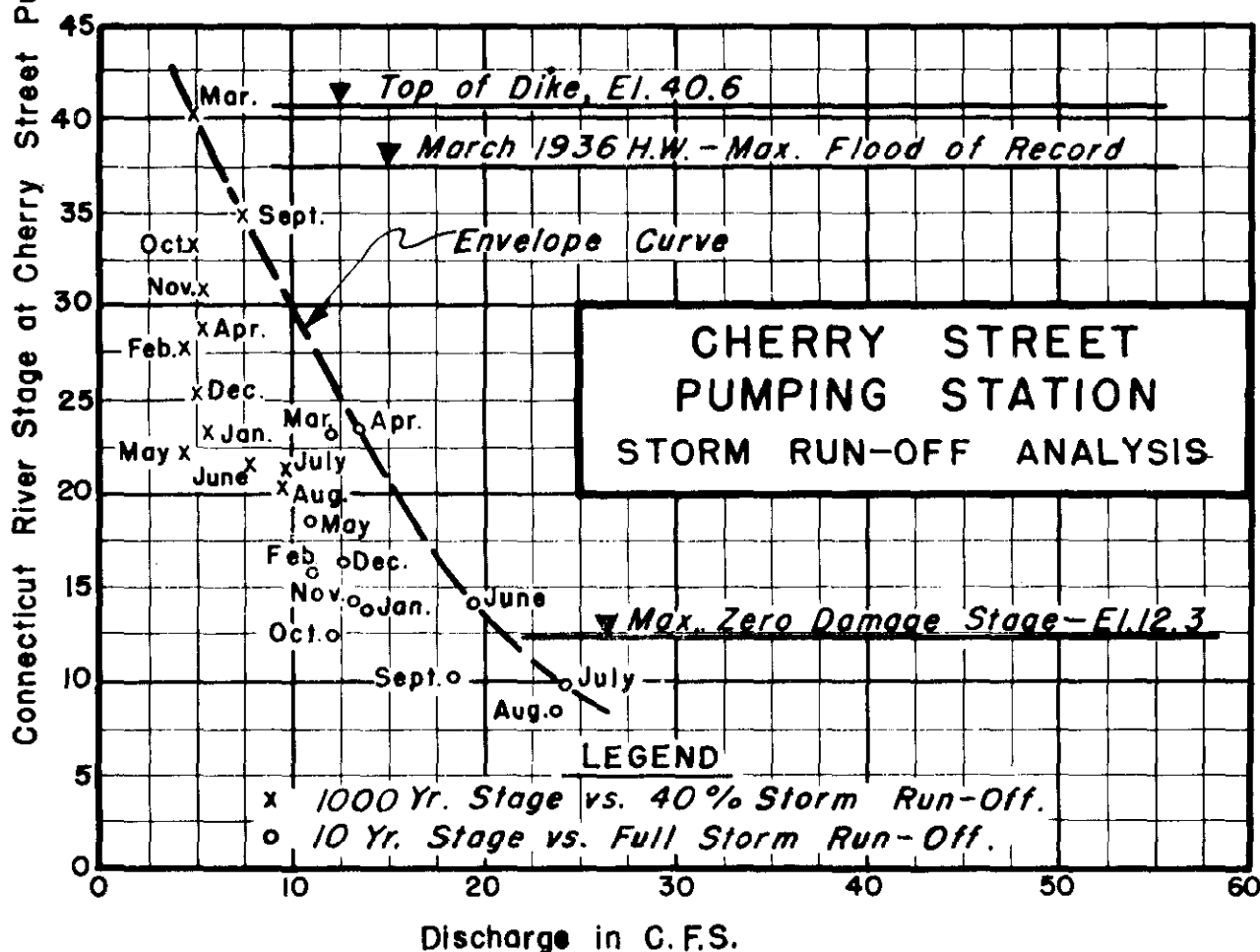
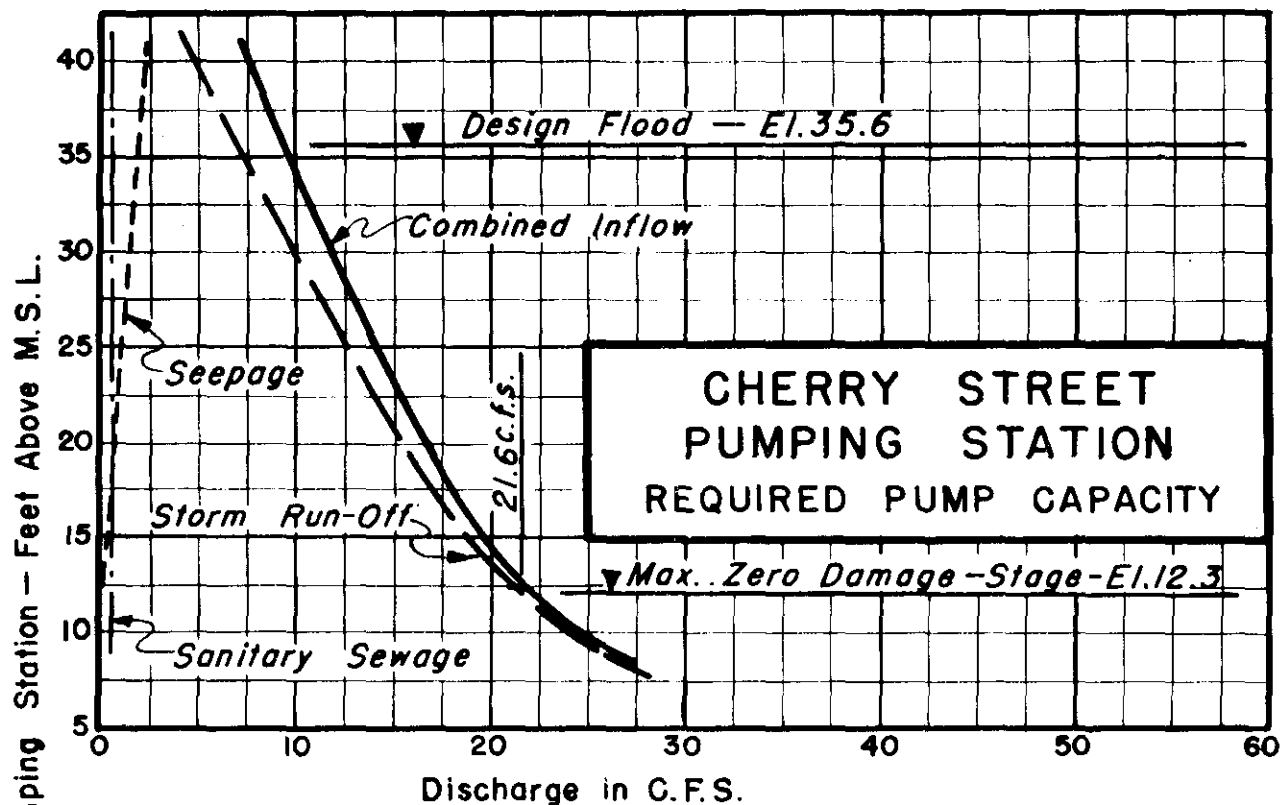
CONNECTICUT RIVER FLOOD CONTROL
 RAINFALL INTENSITY—FREQUENCY CURVES
 1-HOUR STORM
 HARTFORD, CONNECTICUT
 35 YEARS OF RECORD — 1905 TO 1939 INCL.

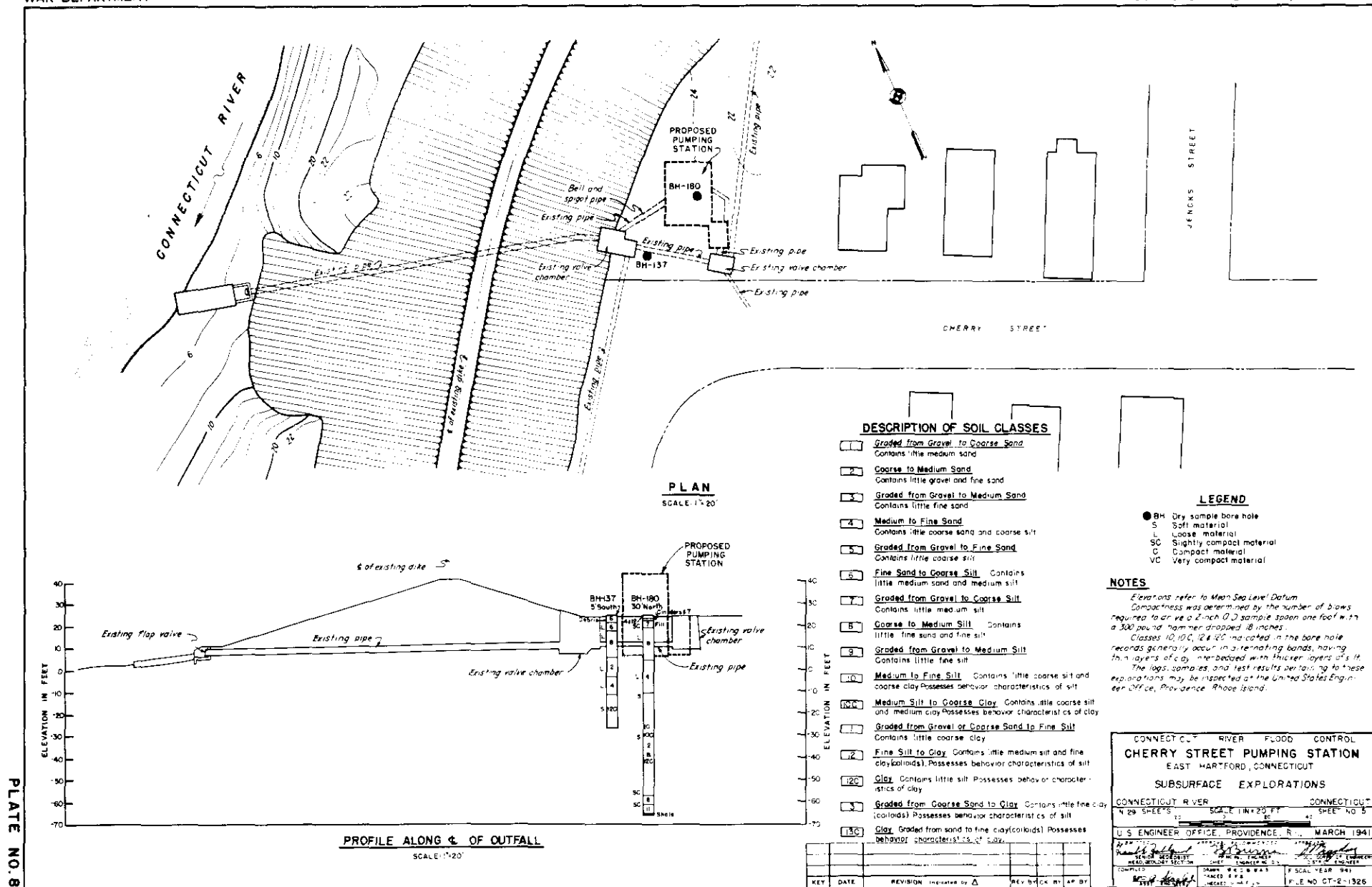


CONNECTICUT RIVER
STAGE — FREQUENCY CURVES
EAST HARTFORD, CONNECTICUT
ZERO HARTFORD GAGE = MINUS 0.55 M.S.L.



CONNECTICUT RIVER
STAGE—DURATION CURVE
AT
EAST HARTFORD





PROVIDENCE DISTRICT SOIL CLASSIFICATION

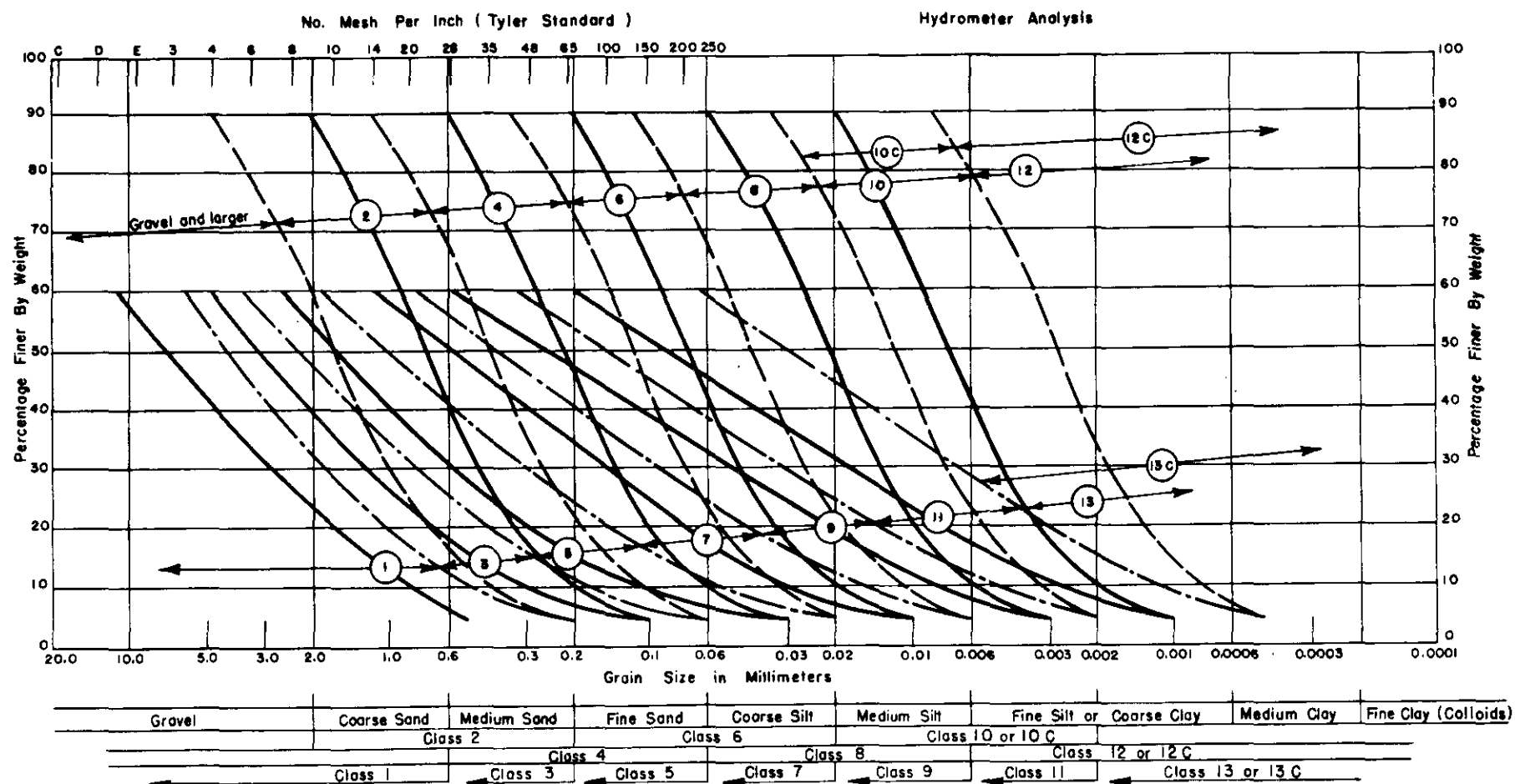
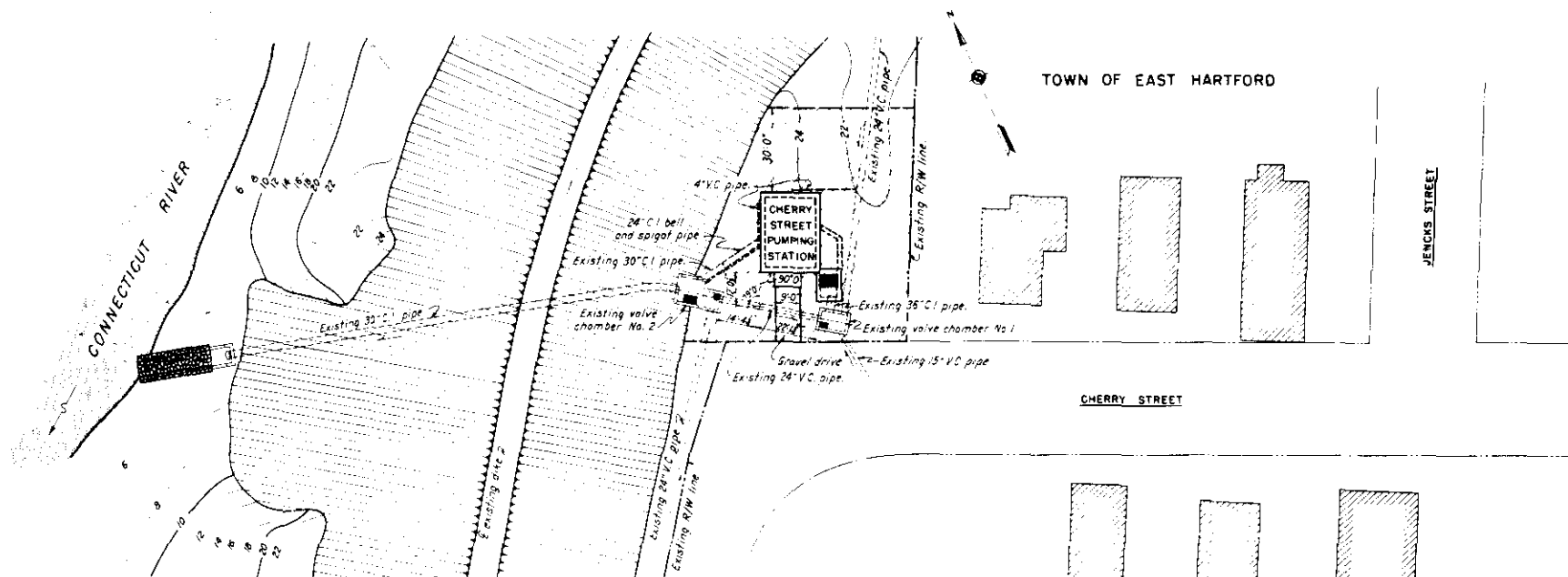


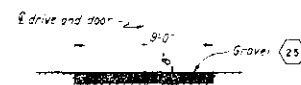
DIAGRAM SHOWING LIMITS OF SOIL CLASSES

PLATE NO. 10



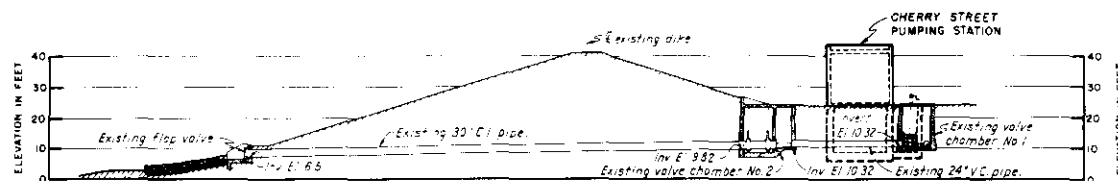
PLAN

SCALE: 1" = 20'



SECTION OF GRAVEL DRIVE

SCALE: 1" = 10'



PROFILE ALONG C OUTFALL

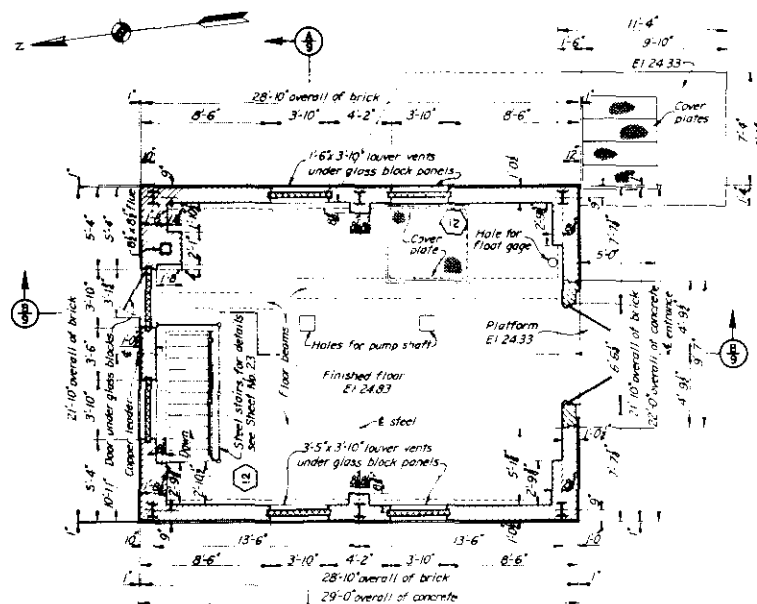
SCALE: 1" = 20'

NOTES

Elevations refer to Mean Sea Level Datum.
Cross hatched area to be sloped to drain,
dressed with 5' of topsoil and seeded.

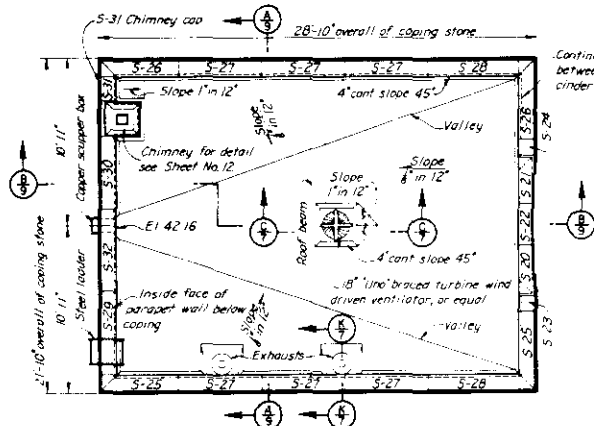
CONNECTICUT RIVER FLOOD CONTROL			
CHERRY STREET PUMPING STATION			
EAST HARTFORD, CONNECTICUT			
GENERAL PLAN			
CONNECTICUT RIVER	SCALE: 1" = 20 FT.	CONNECTICUT	
IN 29 SHEETS	0 20 40	SHEET NO. 2	
U. S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1941			
DESIGNED BY	APPROVED BY	CHECKED BY	DATE
W. J. WILSON	W. J. WILSON	W. J. WILSON	1941
HEAD DESIGN SECTION	CHIEF	ENGINEER	
W. J. WILSON	W. J. WILSON	W. J. WILSON	
FILE NO. CT-4-2923	FISCAL YEAR 1941		

KEY	DATE	REVISION	DESIGNED BY	APPROVED BY	CHECKED BY	DATE



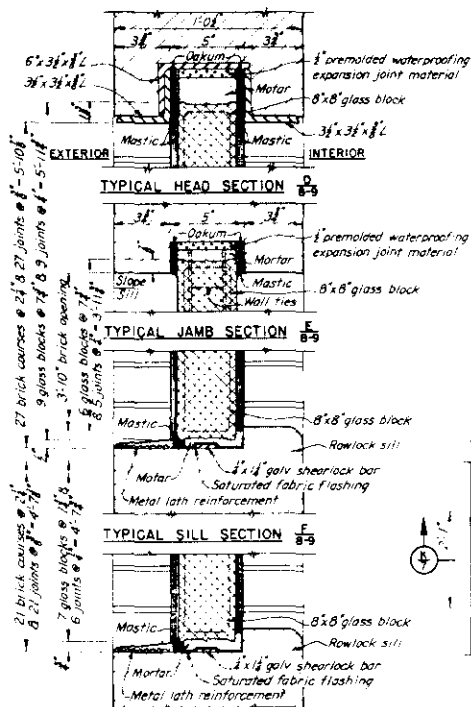
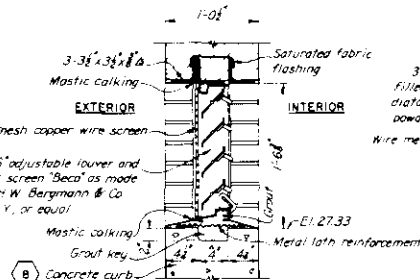
ENGINE ROOM FLOOR PLAN

SCALE 1/4" = 1'-0"



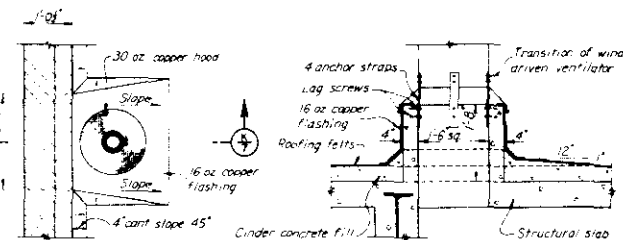
ROOF PLAN

SCALE 1/4" = 1'-0"

SILL SECTION
OCCURS ABOVE SERVICE DOOR ONLY
HEAD & JAMB SAME AS OTHER PANELS
GLASS BLOCK DETAILS
SCALE 3/4" = 1'-0"

HARDWARE SCHEDULE									
LOCATION		LEAF	HINGED	ITEM	REQ'D	SIZE	FINISH	CAT. NO.	PAGE NO.
DOORS AS SPECIFIED Open on - Viewed from outside	ENTRANCE DOOR	Active	Right	Hinge	4	5"x5"	2	8888	439
				Door check	1		2	MB	463
				Lock set	1	2 1/4"x4"	2	1098LNX	203
		inactive	Left	Hinge	4	5"x5"	2	8888	439
				Grips	2	2 1/4"x1/4"	2	074	489
				Foot ball	1	2 1/4"x6"	2	041	374
	SERVICE DOOR	Single	Left	Chain ball	1	2 1/4"x6"	2	040	375
				Hinge	3	5"x5"	2	8888	439
				Lock set	1		2	11248LY14	61
				Door check	1		2	MB	463
Hardware as made by the Russell & Erwin Mfg. Co., New Britain, Conn., or equal.									Volume 16

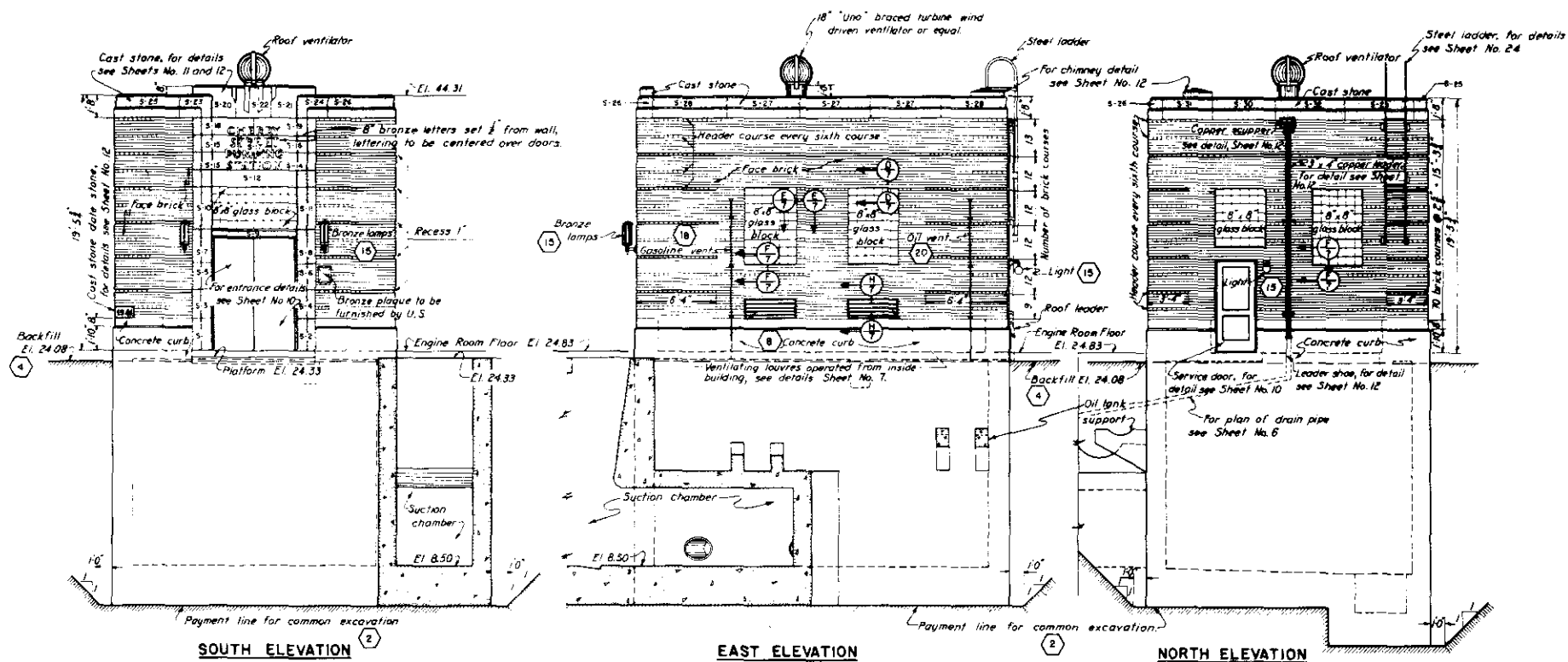
To match locked on active door



NOTES

All items above concrete curb will be paid for under item No 11 except as noted by numbers in hexagons.
Glass block details subject to change to suit glass block used.
Numbers preceded by 'S' are cast stone details, locations and are detailed on Sheets No. 11 & 12.

CONNECT CUT RIVER FLOOD CONTROL	
CHERRY STREET PUMPING STATION	
EAST HARTFORD, CONNECTICUT	
PLANS AND DETAILS	
ARCHITECTURAL	
CONNECTICUT RIVER	CONNECTICUT
V. 29 SHEETS	SHEET NO. 7
SCALE 1/4" = 1'-0"	
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1941	
DESIGNED BY: [Signature]	
CHECKED BY: [Signature]	
APPROVED BY: [Signature]	
FILE NO. CT-4-2925	

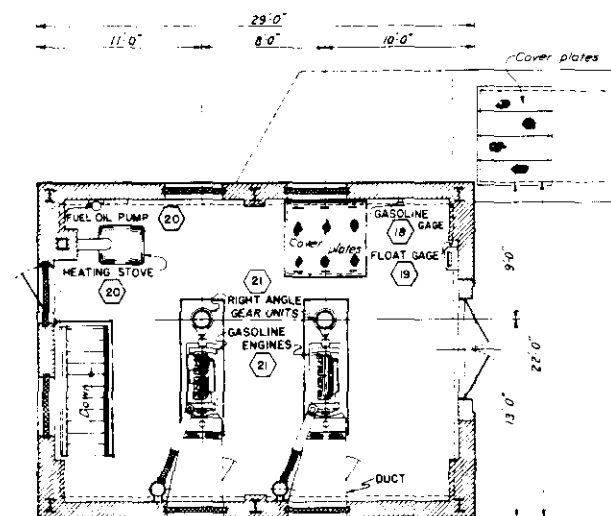
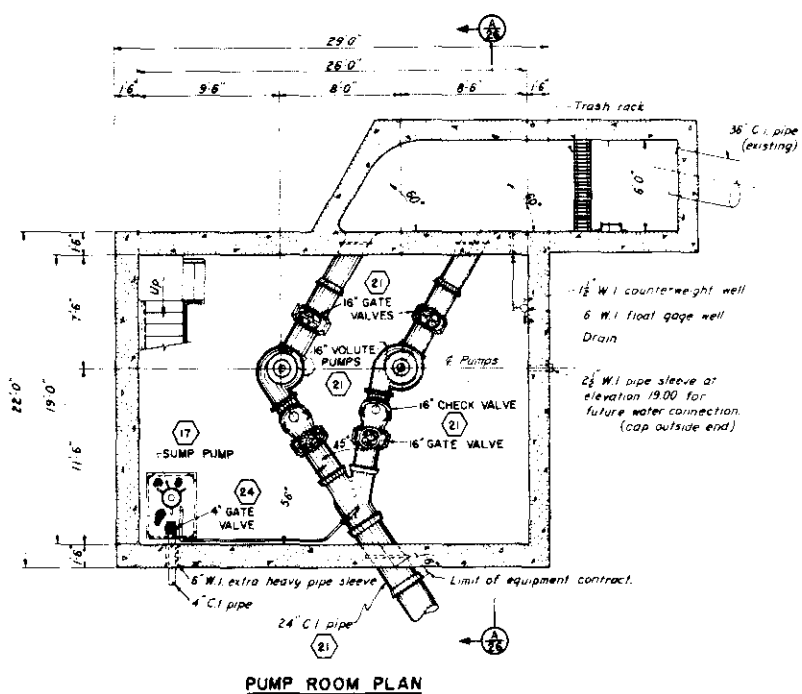


NOTES

All items above concrete curb will be paid for under Item No. 11 except as noted by numbers in hexagons.
All vertical brick dimensions are from bottom of brick joint to bottom of brick joint unless otherwise noted.
Brick dimensions are based on standard brick $2\frac{1}{4} \times 3\frac{1}{2} \times 8"$ with $\frac{1}{2}"$ joints.
For electrical circuits and fixtures see Sheets No. 28 and 29.
Numbers preceded by 'S' are cast stone identifications and are detailed on Sheets No. 11 and 12.

KEY	DATE	REVISION	INITIALS	REV. CHECK BY	AP. BY

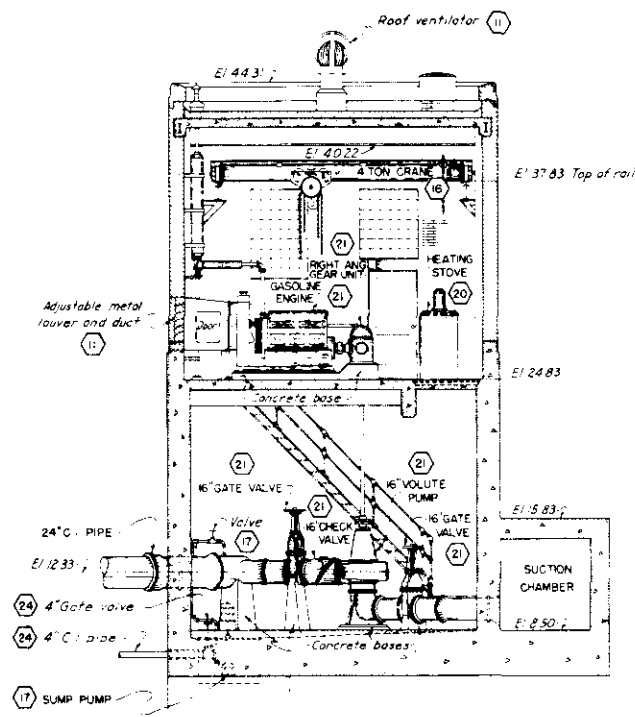
CONNECTICUT RIVER FLOOD CONTROL	
CHERRY STREET PUMPING STATION	
EAST HARTFORD, CONNECTICUT	
ELEVATIONS	
ARCHITECTURAL	
CONNECTICUT RIVER	CONNECTICUT
IN 29 SHEETS	SHEET NO. 8
SCALE: 1/4" = 1'.	
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1941	
DESIGNED BY	APPROVED BY
CHECKED BY	DATE
STATIONED BY	FILE NO. CT-4-2925



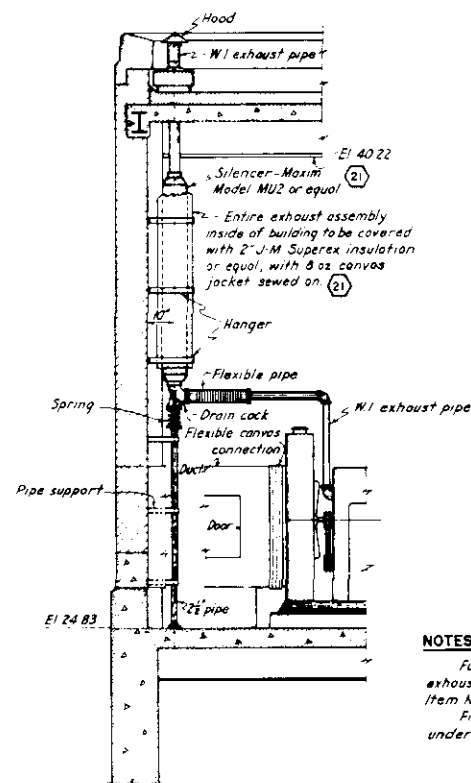
NOTE
Figures in hexagons indicate item numbers under which payment shall be made.

CONNECTICUT RIVER FLOOD CONTROL	
CHERRY STREET PUMPING STATION	
EAST HARTFORD, CONNECTICUT	
GENERAL ARRANGEMENT OF EQUIPMENT	
CONNECTICUT RIVER	CONNECTICUT
IN 25 SHEETS	SHEET NO 25
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1944.	
DESIGNED BY	APPROVED BY
CHECKED BY	ENGINEER BY
SCALE: 1/4" = 1'-0"	FILE NO: 4-2943

KEY	DATE	REVISION	REVISION BY	APPROVED BY



SECTION A-25

SCALE $\frac{1}{8}'' = 1'-0''$ DETAIL OF GASOLINE
ENGINE EXHAUSTSCALE $\frac{1}{8}'' = 1'-0''$

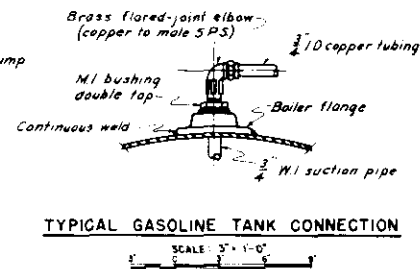
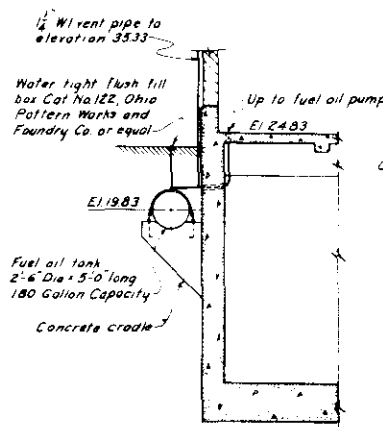
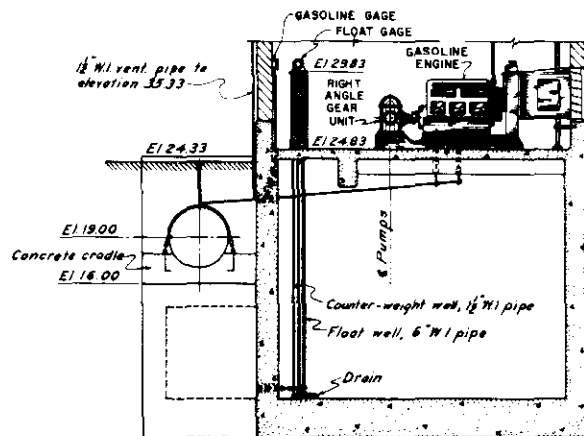
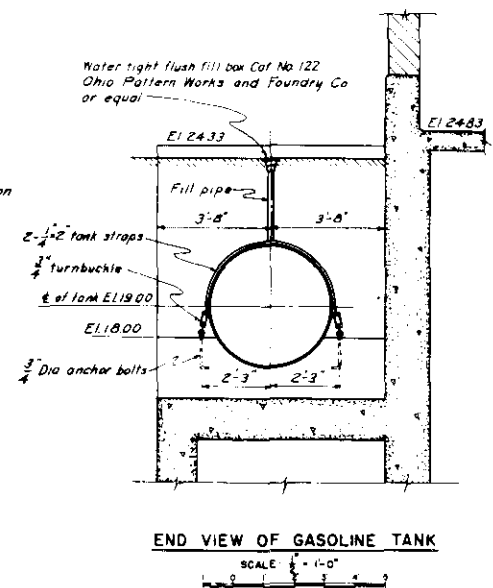
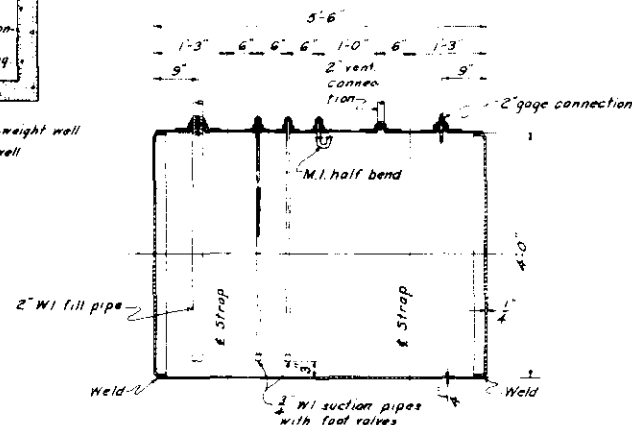
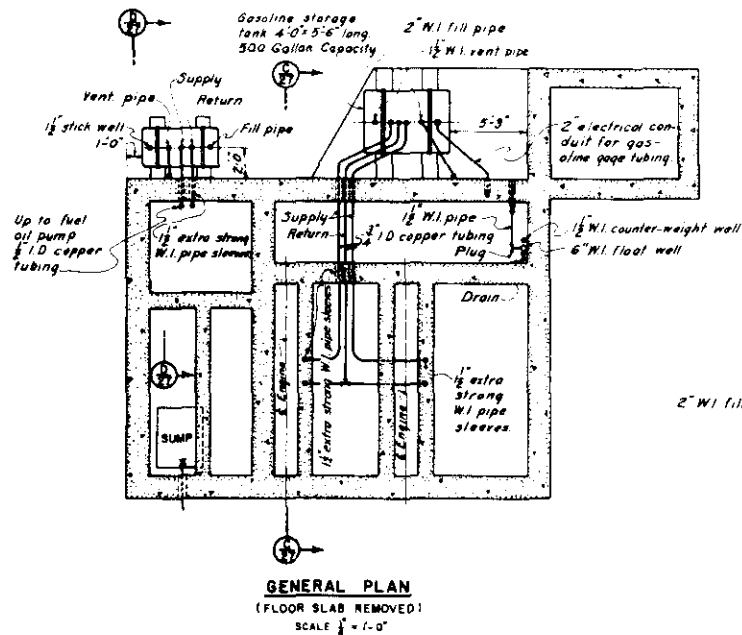
NOTES

Furnishing and installing all insulation on the exhaust pipe assembly will be paid for under Item No. 21

Figures in hexagons indicate item number under which payment shall be made

REV	DATE	BY	CHKD	APP	BY

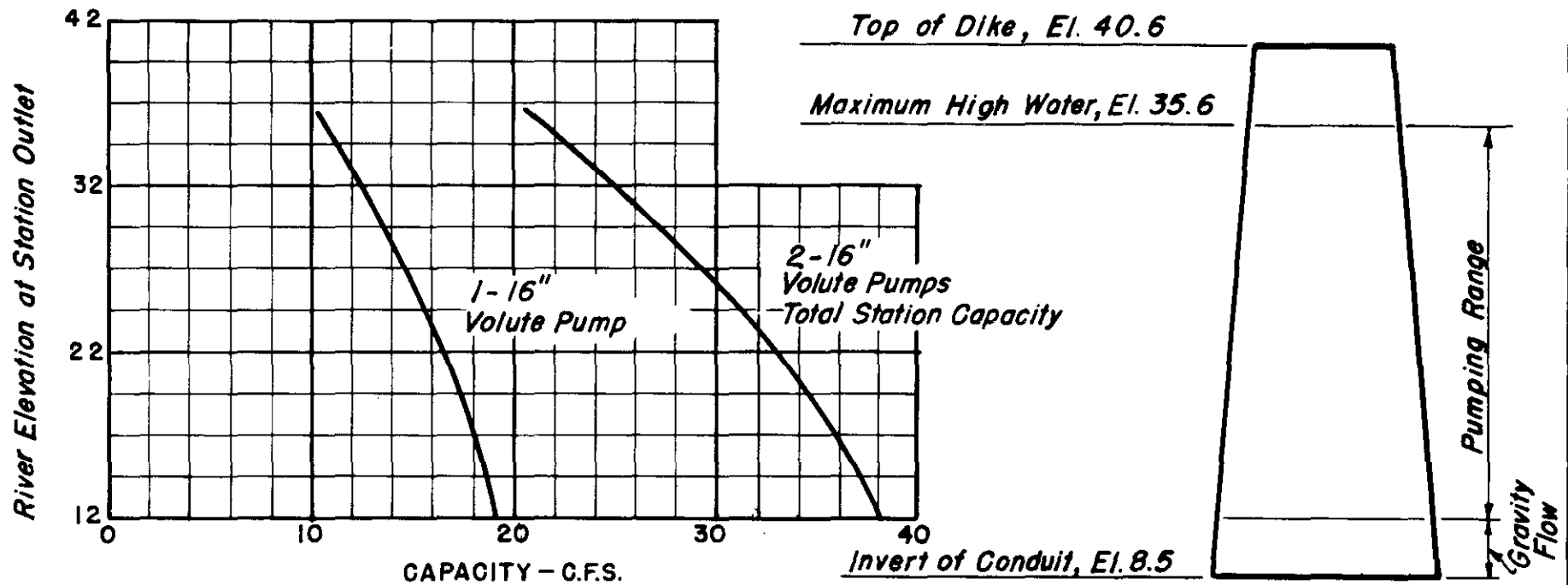
CONNECTICUT RIVER FLOOD CONTROL	
CHERRY STREET PUMPING STATION	
EAST HARTFORD, CONNECTICUT	
MISCELLANEOUS EQUIPMENT	
DETAILS	
CONNECTICUT RIVER	CONNECTICUT
IN 29 SHEETS	SHEET NO 26
SCALE 1/4" = 1'-0"	
U.S. ENGINEER OFFICE, PROVIDENCE, R.I. MARCH 1941	
DESIGNED BY	APPROVED BY
CHECKED BY	ENGINEER
ESTIMATED	FILE NO CT-4-2944



NOTES:
Furnishing and installing gasoline tank and piping will be paid for under Item No 13. Piping is shown diagrammatically. The exact location shall suit the equipment furnished. All piping thru floor and beams shall be set in sleeves, all piping thru outside walls shall be set in sleeves and caulked with lead. Gasoline lines to have constant pitch towards the tank. Piping shall be supported on hangers spaced at eight foot intervals.

CONNECTICUT RIVER FLOOD CONTROL			
CHERRY STREET PUMPING STATION			
EAST HARTFORD, CONNECTICUT			
PIPING DETAILS			
CONNECTICUT RIVER	SCALE: 1/4" = 1'-0"	CONNECTICUT	SHEET NO. 27
IN 29 SHEETS			
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1941			
DESIGNED BY	APPROVED BY	TRACED BY	FILE NO. CT-4-2845
DRONE	P.R.	TRACED BY	FILE NO. CT-4-2845
CHECKED BY	APPROVED BY		

CHERRY STREET PUMPING STATION PUMPING CAPACITY



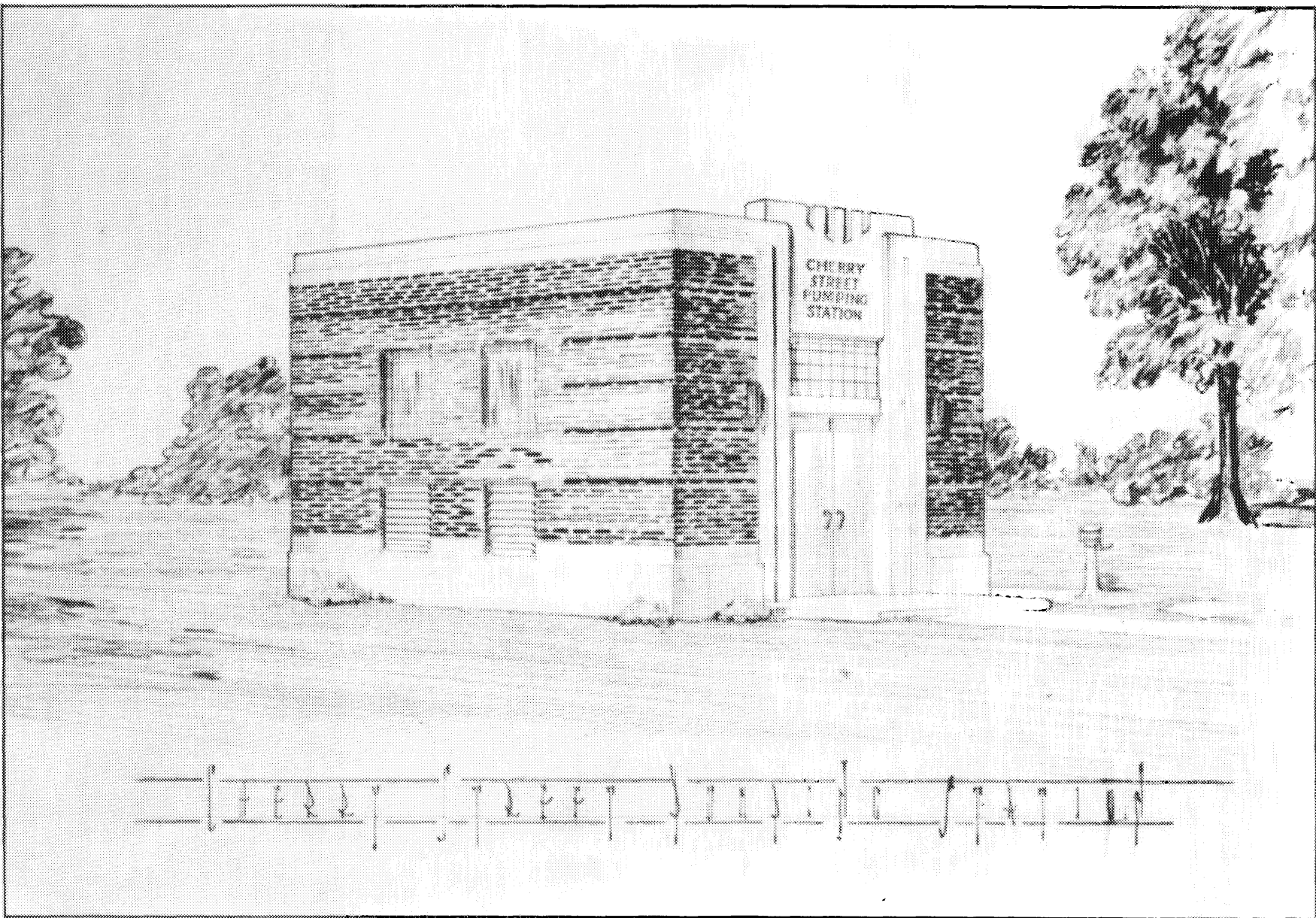
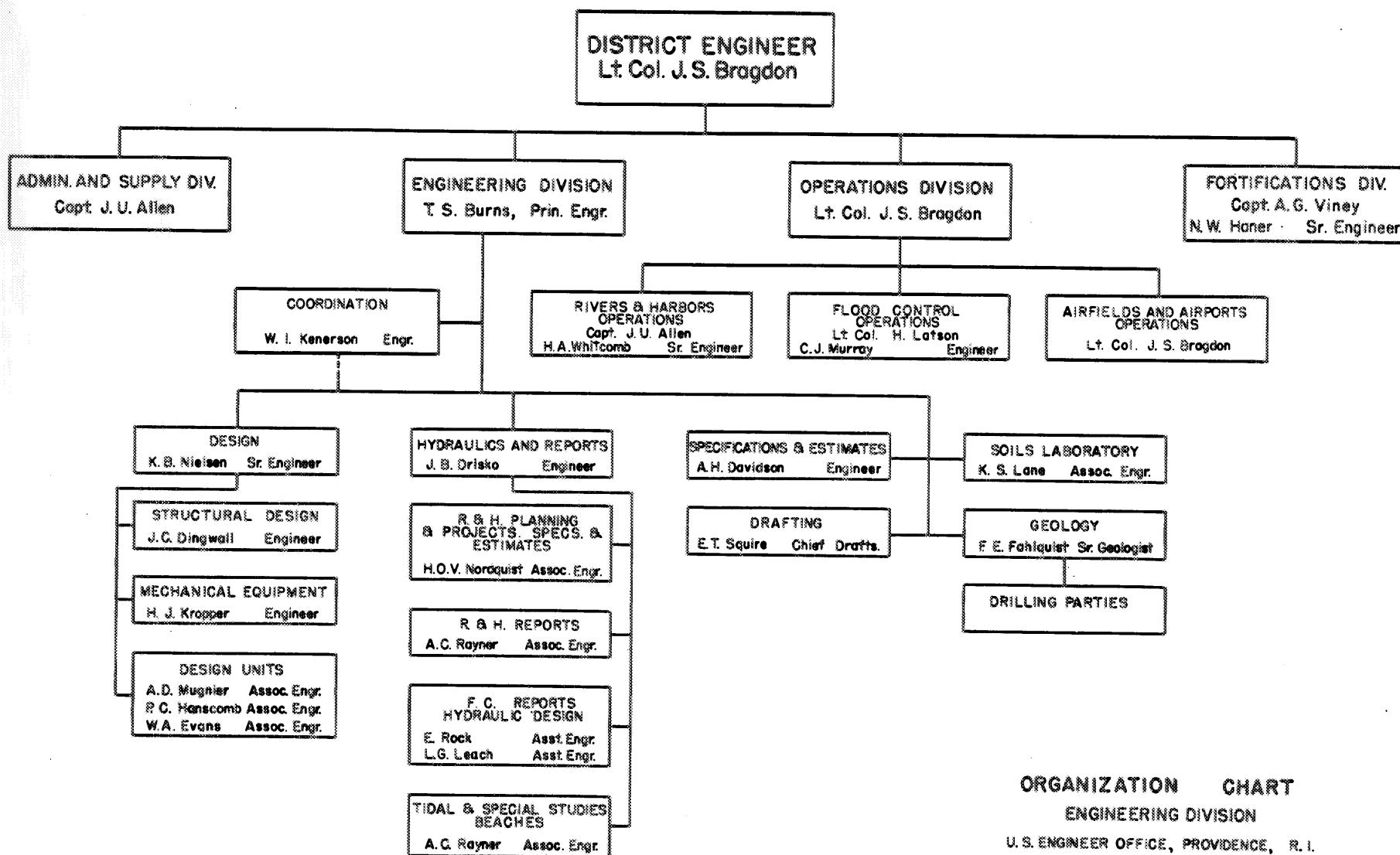


PLATE NO. 18



ORGANIZATION CHART
ENGINEERING DIVISION
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.
APRIL 1941